

Removal of Chemical Compounds in Wastewater Treatment Plants

- **Treatment**

- **Biodegradation
(transformation/mineralization)**
- **Hydrolysis and photolysis**

- **Surface volatilization and air stripping**

- **Sorption**

- **Ion exchange and organic binding (90-95%)**
- **Adsorption and precipitation (< 10%)**

Removal Mechanisms for Select Groups of Compounds

- **Heavy Metals – only by sorption (includes precipitation)**
- **Volatile Organic Compounds (VOCs) – biodegradation and volatilization**
- **Hydrophobic Organics – biodegradation, volatilization, and sorption**

Heavy Metals Sorption to Biosludge

- **Cation exchange with biopolymers**
- **Bind to cell walls and membranes in ionic form**
- **Can become internalized (70% of Cr (III) intercellular)**
- **Increased removal with increased pH**
- **Increased removal with increased sludge age**
- **Rapid process (equilibrium in 1 to 2 hours)**

Determinations for SARA Report

1. Analytical data whenever available

- **NPDES discharge monitoring reports (monthly metals and quarterly organics)**
- **Sludge analysis for BIF**
- **Gas chromatography on influent**
- **Analyses for Universal Treatment Standard List for RCRA LDR Compliance**
- **Additional special sampling**

2. Modeling with Toxchem⁺

Selection of Toxchem⁺

- **Used an in-house model until mid-1990's**
- **Field data from full-scale WWTP and pilot plant demonstrated overestimation of air emissions**
- **Toxchem commercially available and recognized by EPA as one of the accepted models for Method 304**
 - **User friendly**
 - **Calculation methods well-documented**
 - **Estimations compare more favorably to data**

Toxchem⁺ Demonstration